Hayabusa2 landing site selection (LSS) training: Summary report of scientific evaluation

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The Japanese C-type asteroid sample return mission, Hayabusa2, was launched on December 3, 2014. The spacecraft is scheduled to arrive at the near Earth asteroid Ryugu on July 2018. During its 18-month stay, remote-sensing observations will be carried out by the on-board instruments, Optical Navigation Camera (ONC), Near Infrared Spectrometer (NIRS3), Thermal Infrared Imager (TIR), and Light Detection and Ranging (LIDAR). Based on the observation data, the collection of the asteroid samples from three sites at maximum will be performed. We will carry out the landing site selection (LSS) within a month after the arrival to Ryugu, for the first touch down and for the release of MASCOT, a small hopping rover developed by DLR and CNES on October 2018.

It is therefore very important that scientists from remote sensing, MASCOT, and sample analyses are mingled to work out a landing site selection strategy by sharing the common picture of the multi-scale asteroid science. During this June-August 2017, we carried out the LSS training by using the asteroid Ryugu analog model "Ryugoid". Beginning of shape modeling, the data products such as surface temperature, thermal inertia, grain sizes, visible and near infrared spectra, and spectral parameters (albedo, UV slope) were obtained from the Box A (at 20 km in altitude), Box C and mid-a
ltitude (at 5 km in altitude) observations by TIR, ONC, NIRS3, and LIDAR teams. Then, six potential landing sites (zones A, B, C, D, D2, and E, in figure) were indicated by the system side. Based on the products, scientific evaluations (e.g., compositions and distributions of hydrate minerals, relative abundance of organic carbon, thermal metamorphism degree, space weathering degree, and number density of boulders) of these zones were conducted in order to prioritize the first landing site. This training has made us prepare for the actual LSS next year, to determine the most scientifically valuable site, that is, water-rich region.

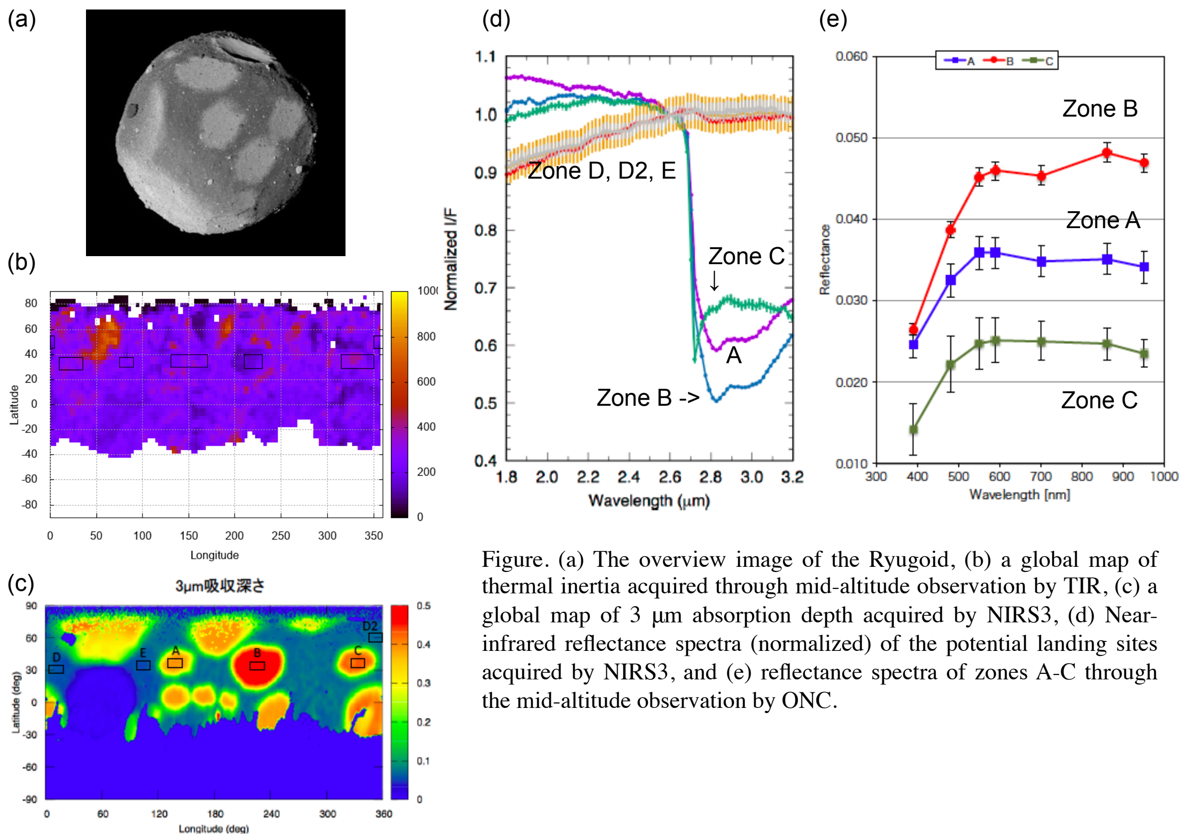

Figure. (a) The overview image of the Ryugoid, (b) a global map of thermal inertia acquired through mid-altitude observation by TIR, (c) a global map of 3 μm absorption depth acquired by NIRS3, (d) Near-infrared reflectance spectra (normalized) of the potential landing sites acquired by NIRS3, and (e) reflectance spectra of zones A-C through the mid-altitude observation by ONC.

References: [1] Tachibana. S. et al. 2014. Geochemical Journal 48, 571-587.